

RuggedWireless™ RS900W Family



Installation Guide

www.ruggedcom.com

Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense.

Caution

This product contains a laser system and is classified as a "CLASS 1 LASER PRODUCT".

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. This product contains no user serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

Should this device require service see the "Warranty" section of this installation guide.

Important

This unit should be installed in a restricted access location where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

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1 Product Overview

1.1 Functional Overview

The RuggedWireless™ RS900W family of products are industrially hardened, fully managed, IEEE 802.11g Access Points with integrated Ethernet switching, specifically designed to operate reliably in electrically harsh and climatically demanding industrial environments. The RS900W's superior ruggedized design coupled with the RS900W's RuggedWireless™ Operating System (ROS) provides improved system reliability and advanced networking features making it ideally suited for creating 802.11g Wireless Ethernet networks for mission-critical, real-time, control applications.

The RS900W can be equipped with dual 100Mbps fiber optical Ethernet ports for creating a fiber optical backbone with high noise immunity and long haul connectivity. The RS900W also provides dual power inputs for backup power and is packaged in a rugged steel enclosure that can be DIN rail or panel mounted.

1.2 Feature Highlights

- Complies with the IEEE 802.11g 2.4GHz specification (Wireless LAN) including “fallback” (backward) compatibility with IEEE802.11b station-client devices.
- High wireless data rates: 54, 48, 36, 24, 18, 12, 11, 5.5, 2 and 1Mbps network speed.
- The RW80 Access Point functionality will seamlessly integrate wireless and wired Ethernet LAN networks.
- Auto rate fallback in case of obstacles or interferences.
- Basic security is provided with 64/128-bit WEP Data Encryption function to protect the wireless data transmissions.
- Enhanced security is provided by WPA and TKIP data-encryption method.
- Robust security is provided by 802.11i/WPA2 (backward compatible with WPA stations) and AES (with CCMP) data-encryption method.
- Both WPA and WPA2 modes both feature *Enterprise* and *Personal* configurations for key management. *Enterprise* mode will offer IEEE 802.1x security (EAP with RADIUS) while *Personal* offers Pre-Shared Key (PSK) “passphrase” to generate keys for authentication.
- Integrated ROS™ configuration methods.
- Exceeds IEC 61000-6-2 standards for industrial environments and NEMA TS-2 standards for traffic control equipment.
- Operating temperature: -40° to 85°C (no fan)
- Power supply options: 12, 24 or 48VDC, and universal HI (88-300VDC or 84-264VAC)
- Dual, independent inputs for 24 and 48VDC power supplies for redundancy
- Failsafe output relay for critical failure or error alarming
- Advanced layer-2 switching functions: Rapid Spanning Tree, Message Prioritization and Virtual LANs
- Full-duplex operation (no collisions) with flow-control

1.3 RS900W Family Front Panel View

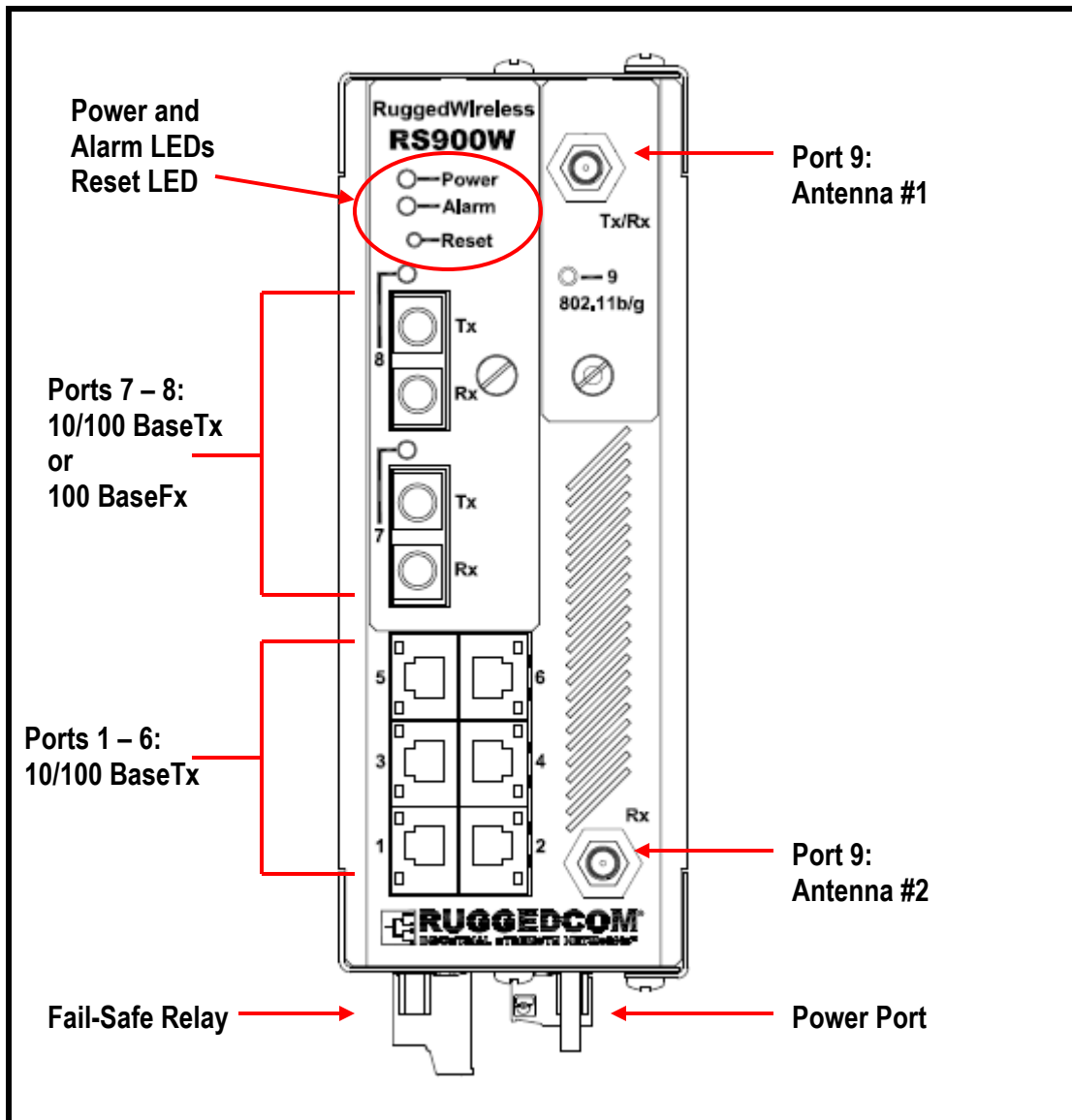


Figure 1 - Front Panel Description

ITEM	Activity	Comments
LINK LED (Yellow)	Solid	Link Established
	Blinking – Once per second	Tx/Rx Activity
Power LED	Solid	Power On
Alarm LED	Solid	Alarm condition exists

Table 1 - Status LEDs

1.4 RS900W Family Bottom Panel View

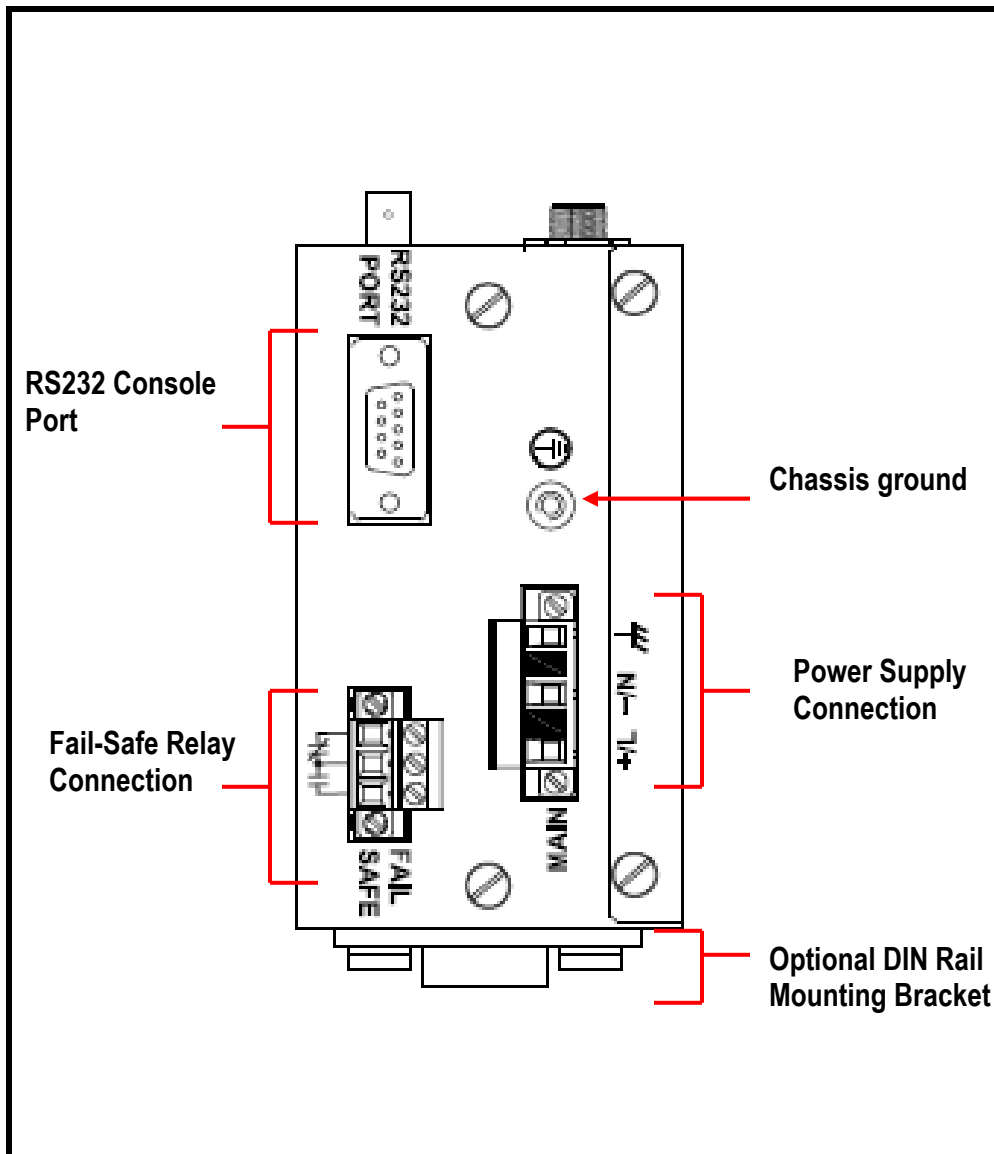


Figure 2 - Bottom Panel Description

2 Installation

2.1 DIN Rail Mounting

An optional DIN rail mounting bracket is available for the RS900W. Figure 2.1.1 details mounting instructions for the standard 1" DIN Rail.

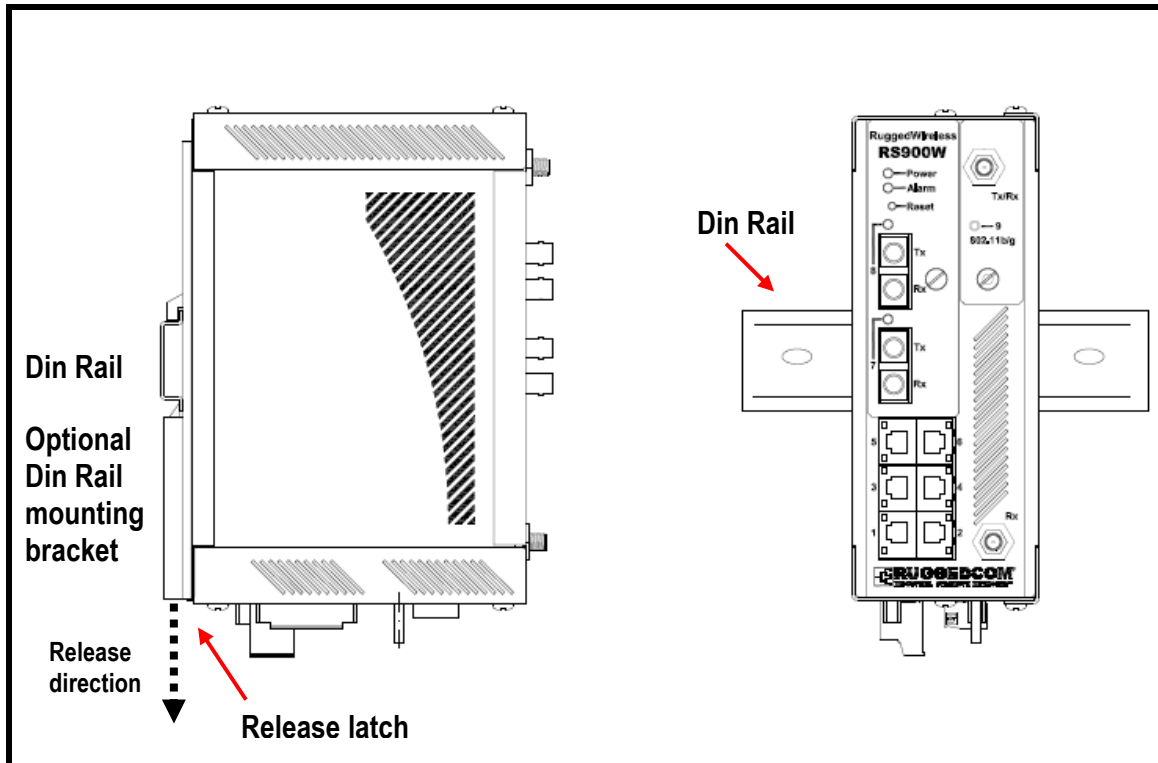


Figure 3 - DIN Rail Mounting

2.2 Power Supply Wiring and Grounding

2.2.1 AC Power Supply Wiring and Grounding

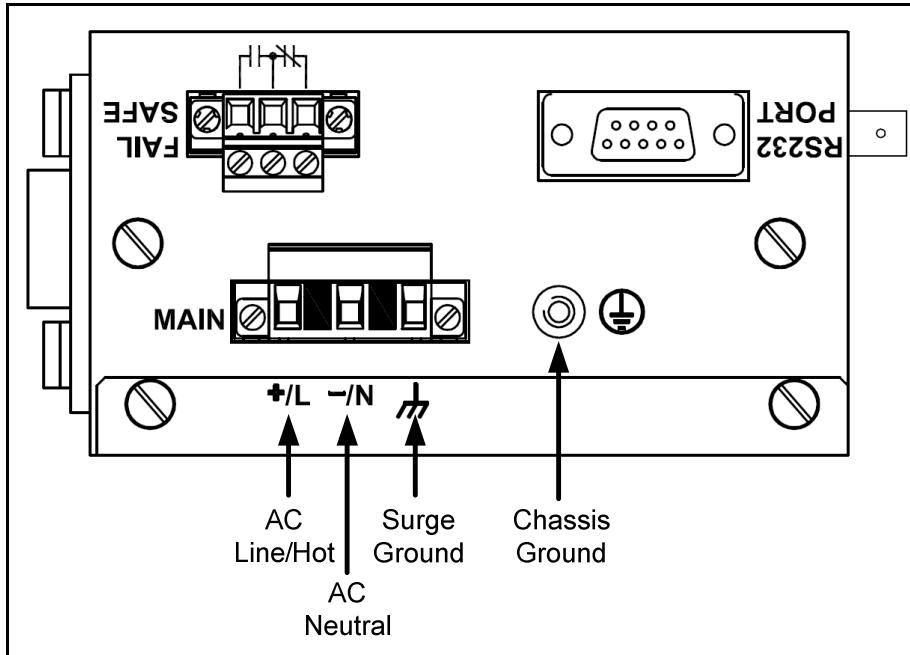


Figure 4 - Power Supply Inputs

The AC power supply inputs should be connected as follows:

1. +/L should be connected to AC Line/Hot.
2. -/N should be connected to AC Neutral.
3. Surge Ground should be connected to the Chassis Ground via a braided cable or other appropriate grounding wire. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry internal to the unit.
4. Chassis Ground must be connected to the AC ground terminal.

NOTES:

1. Equipment must be installed according to the applicable country wiring codes.
2. All line-to-ground transient energy is shunted to the Surge Ground terminal. In cases where users require the inputs to be isolated from ground, remove the ground braid between Surge and Chassis Ground. Note that all line-to-ground transient protection circuitry will be disabled.

2.2.2 DC Power Supply Wiring and Grounding

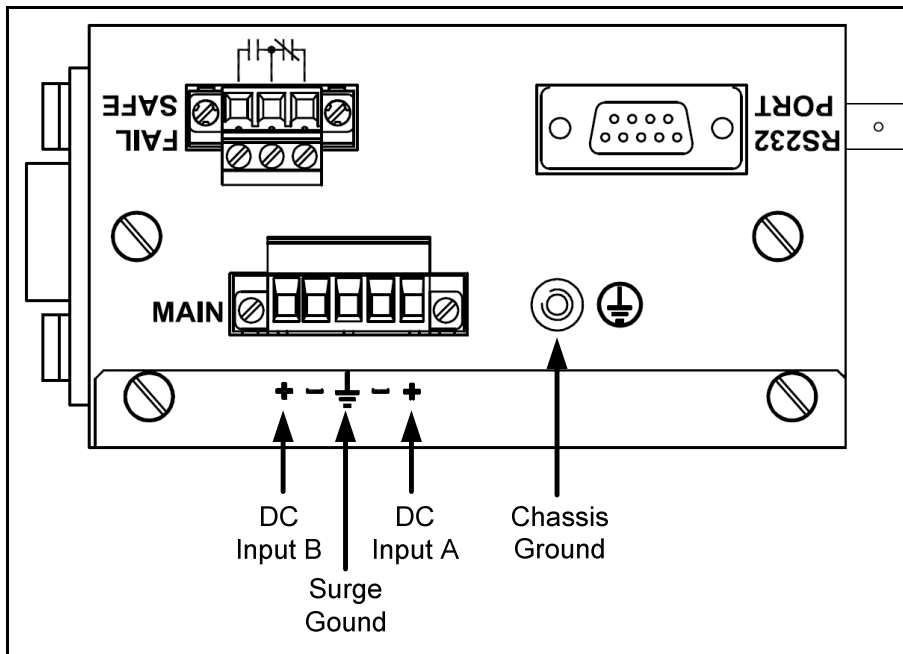


Figure 5 - DC Power supply wiring and grounding diagram

The low voltage DC power supply features reverse polarity protection and dual independent inputs. The latter feature allows the connection of two DC sources with the same nominal voltage to provide redundant power supply inputs.

The DC power supply inputs should be connected as follows:

1. Connect to the DC inputs according to the polarity markings on the unit.
2. Surge Ground should be connected to the Chassis Ground via a braided cable or other appropriate grounding wire. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry internal to the unit.
3. Chassis Ground must be connected to the protective earth.

NOTES:

1. Equipment must be installed according to the applicable country wiring codes.
2. All line-to-ground transient energy is shunted to the Surge Ground terminal. In cases where users require the inputs to be isolated from ground, remove the ground braid between Surge and Chassis Ground. Note that all line-to-ground transient protection circuitry will be disabled.

2.3 Dielectric Strength (HIPOT) Testing

Units which are to have dielectric strength testing (HIPOT testing) done in the field must have the braided ground cable disconnected during the test. This is required in order to prevent the surge suppression circuitry, which is connected to surge ground, from being activated.

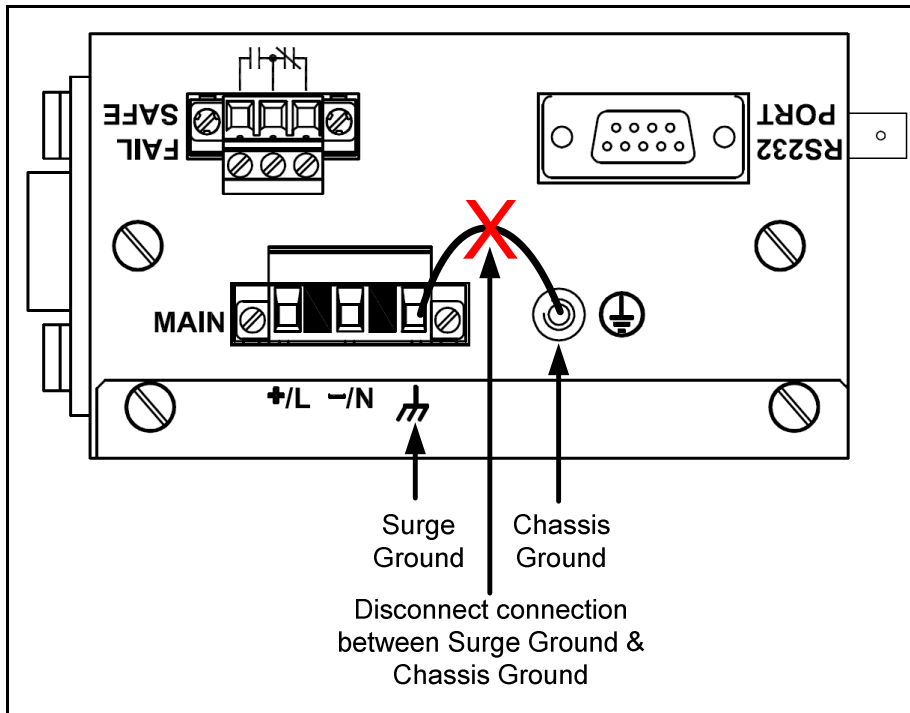


Figure 6 - Dielectric Strength Testing

2.4 Failsafe Output Wiring and Specifications

The Failsafe output relay is provided to signal critical error conditions that may occur on the unit. The contacts are energized upon power up of the unit and remain energized until an alarm condition or power loss occurs.

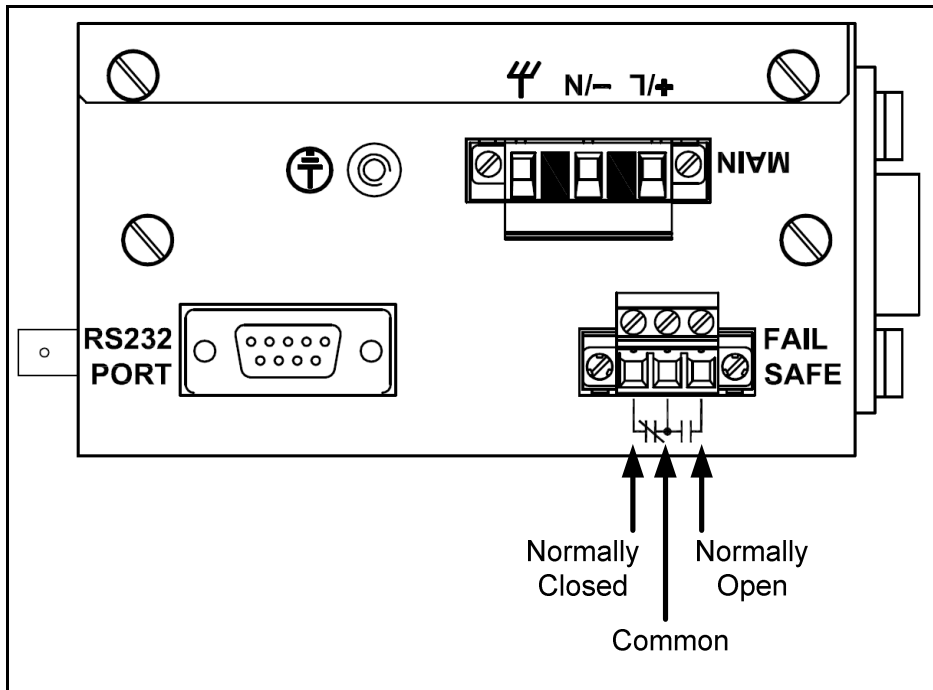


Figure 7 - Failsafe Output Relay

2.5 RS232 Port Wiring

The RS232 port is used for configuring the unit. A straight-through serial cable with a DB-9 connector is required. There is no need to crossover the Transmit and Receive signals from the PC side since this has been done internally as is shown below.

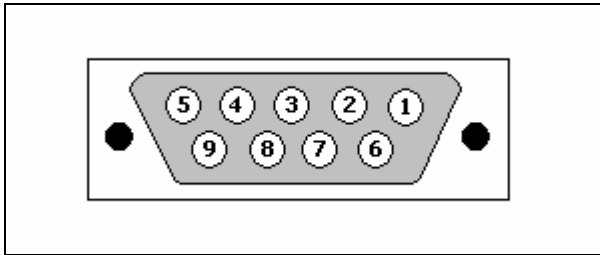


Figure 8 - RS232 Female DCE pin-out

Pin	Signal
1	No Connection
2	Transmit Data
3	Receive Data
4	No Connection
5	Ground
6	No Connection
7	No Connection
8	No Connection
9	No Connection

Table 2 - RS232 Female DCE pin-out

NOTE: This port is not intended to be a permanent connection and the cable shall be less than 2m (6.5 ft) in length.

2.6 RJ45 Ports – Signal Description

Units with 10/100Base-TX ports allow connection to standard Category 5 (CAT-5) unshielded twisted-pair (UTP) cable with RJ45 male connectors. The RJ45 receptacles are directly connected to the chassis ground on the unit and can accept CAT-5 shielded twisted-pair (STP) cables. If shielded cables are used, care must be taken to ensure the shielded cables do not form a ground loop via the shield wire and the RJ45 receptacles at either end. The figure below shows the shows the RJ45 port pin-out and LEDs.

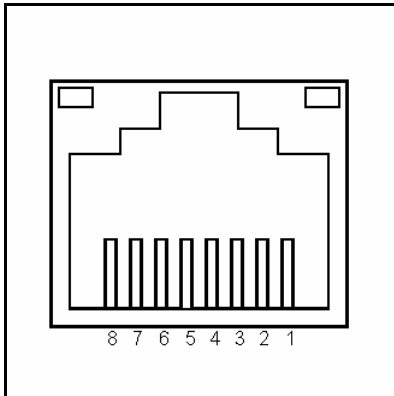


Figure 9 - RJ45 port pin-out and LEDs

Pin	Signal
1	+Rx
2	-Rx
3	+Tx
4	No Connection
5	No Connection
6	-Tx
7	No Connection
8	No Connection
Case	Shield (Chassis Ground)

Table 3 - RJ45 port pin-out

NOTE: RuggedCom does not recommend the use of copper cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients and to ensure IEC 61850-3 and IEEE 1613 Class 1 conformance. This means that during the transient event communications errors or interruptions may occur but recovery is automatic.

RuggedCom also does not recommended to use these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

3 Technical Specifications

3.1 Operating Environment

Parameter	Range	Comments
Ambient Operating Temperature	-40 to 85°C	Ambient Temperature as measured from a 30 cm radius surrounding the center of the enclosure.
Ambient Storage Temperature	-40 to 85°C	
Ambient Relative Humidity	5% to 95%	Non-condensing

Table 4 - Operating Environment

3.2 Power Supply Specifications

Power Supply Type	Minimum Input	Maximum Input	Fuse Rating	Isolation	Maximum Power Consumption
12 – 24 VDC	10 VDC	36 VDC	3.15 (T)	1.5 kV DC	10W
24 VDC	18 VDC	36 VDC	3.15 (T)	1.5 kV DC	
48 VDC	36 VDC	72 VDC	3.15 (T)	1.5 kV DC	
HI (125/250 VDC) ¹ HI (110/230 VAC) ¹	88 VDC 85 VAC	300 VDC 265 VAC	3.15 (T)	4 kV AC 5.5 kV DC	

Table 5 - Power Supply Specifications

NOTES:

1. This is the same power supply for both AC and DC.
2. (F) Denotes fast-acting fuse, (T) denotes time-delay fuse.
3. For continued protection against risk of fire, replace only with same type and rating of fuse.

3.3 Failsafe Relay Specifications

Parameter	Value
Max Switching Voltage	30VAC, 80VDC
Rated Switching Current	0.3A @ 30VAC 1A @ 30VDC, 0.3A @ 80VDC

Table 6 - Failsafe Relay Specification

NOTES:

1. Resistive Load.
2. For Class-2 circuits only.

<i>Isolation</i>	<i>Comments</i>
1500 V _{rms}	Dielectric test voltage (1 minute) between coil & contacts

Table 7 - Failsafe Relay Isolation

3.4 RJ45 Ethernet Port Specifications

<i>Data Port</i>	<i>Media</i>	<i>Distance</i>	<i>Connector Type</i>
10/100 Mbps	CAT-5 UTP or STP	100m	RJ45

Table 8 – RJ45 Ethernet Port Specifications

3.5 Wireless Standards Supported

Standard	Parameter	Mode	Notes
IEEE 802.11g	54 Mbps (WLAN)	Full Access Point	2.4 Ghz ISM
IEEE 802.11b	11 Mbps (WLAN)	Client support	Backwards compatibility
IEEE 802.11i	Strong Encryption	WPA2-AES (CCMP)	Robust Secure Network (RSN)
	Enhanced Encryption	WPA-TKIP (RC4)	Temporal keys
	Basic Encryption	WEP (RC4)	Up to 4 static keys
IEEE 802.1x	Wireless Authentication	'Personal' or 'Enterprise'	PSK or RADIUS

Table 9 - Wireless Standards supported

3.6 Radio Characteristics

Standard	Parameter
Modulation	Direct Sequence Spread Spectrum 802.11b / OFDM 802.11g
Frequency Range	2.4 Ghz – 2.4965 Ghz
Data Rate	6-54 Mbps: OFDM 11 Mbps: CCK 5.5 Mbps: CCK 2 Mbps: DQPSK 1 Mbps: DBPSK
Channels	11 – US (FCC) 11 - CAN (IC) 14 – Japan (MKK) 13 – Other countries (ETS)
Output Power	100 mW (20dBm) 802.11b 11Mbps Data Rate 100 mW (20dBm) 802.11g 6-24Mbps Data Rate 79 mW (19dBm) 802.11g 36Mbps Data Rate 63 mW (18dBm) 802.11g 48Mbps Data Rate 40 mW (16dBm) 802.11g 54Mbps Data Rate
Receiver Sensitivity	At Radio 802.11b 11Mb@-88dBm / With Antenna: 11Mb@-91dBm At Radio 802.11g 54Mb@-74dBm / With Antenna: 54Mb@-77dBm

Table 10 - Radio Characteristics

3.7 IEEE 802.11b/g

The channel identifiers, channel center frequencies, and regulatory domains of each IEEE 802.11b/g 22-MHz-wide channel are shown in Figure 2.7.1

Channel Identifier	Frequency (in MHz)	Regulatory Domains			
		America (-A)	EMEA (-E)	Japan (-J)	Rest of World (-W)
1	2412	X	X	X	X
2	2417	X	X	X	X
3	2422	X	X	X	X
4	2427	X	X	X	X
5	2432	X	X	X	X
6	2437	X	X	X	X
7	2442	X	X	X	X
8	2447	X	X	X	X
9	2452	X	X	X	X
10	2457	X	X	X	X
11	2462	X	X	X	X
12	2467	-	X	X	X
13	2472	-	X	X	X
14	2484	-	-	X	-

Table 11 - Channel allocations for IEEE 802.11b/g

NOTES:

- Mexico is included in the Rest of World regulatory domain; however, channels 1 through 8 are for indoor use only while channels 9 through 11 can be used indoors and outdoors. Users are responsible for ensuring that the channel set configuration complies with the regulatory standards of Mexico.
- In Japan, channel 14 is not supported for 802.11g mode.

3.8 Fiber Optical Port Specifications

Order Code	Speed Standard	Mode / Connector	Tx (nm)	Cable Type (um)	Tx min (dBm)	Tx max (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Typical Distance (km)	Power Budget (dB)
MJ	100FX	MM/MTRJ	1300	50/125 62.5/125	-22.5 -19	-14 -14	-33.5 -33.5	-14 -14	2 2	11 14.5
MC	100FX	MM/SC	1300	50/125 62.5/125	-22.5 -19	-14 -14	-33.9 -33.9	-14 -14	2 2	11.4 14.9
MT	100FX	MM/ST	1300	50/125 62.5/125	-22.5 -19	-14 -14	-33.9 -33.9	-14 -14	2 2	11.4 14.9
ML	100FX	MM/LC	1310	62.5/125	-19	-14	-32	-14	2	13
T2	100FX	SM/ST	1310	9/125	-15	-7	-34	-3	20	19
L2	100FX	SM/LC	1300	9/125	-15	-8	-38	-3	20	23
C2	100FX	SM/SC	1300	9/125	-15	-8	-31	-7	20	16
L5	100FX	SM/LC	1310	9/125	-5	0	-35	-3	50	30
C5	100FX	SM/SC	1310	9/125	-5	0	-34	-3	50	29
L9	100FX	SM/LC	1310	9/125	0	5	-37	0	90	37
C9	100FX	SM/SC	1310	9/125	5	0	-37	0	90	42

Table 12 - Fiber Optic Port Specifications

NOTES:

1. All values listed are average values
2. To convert from average to peak add 3 dBm. To convert from peak to average, subtract 3 dBm.
3. Maximum segment length is greatly dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.

3.9 Physical Dimensions

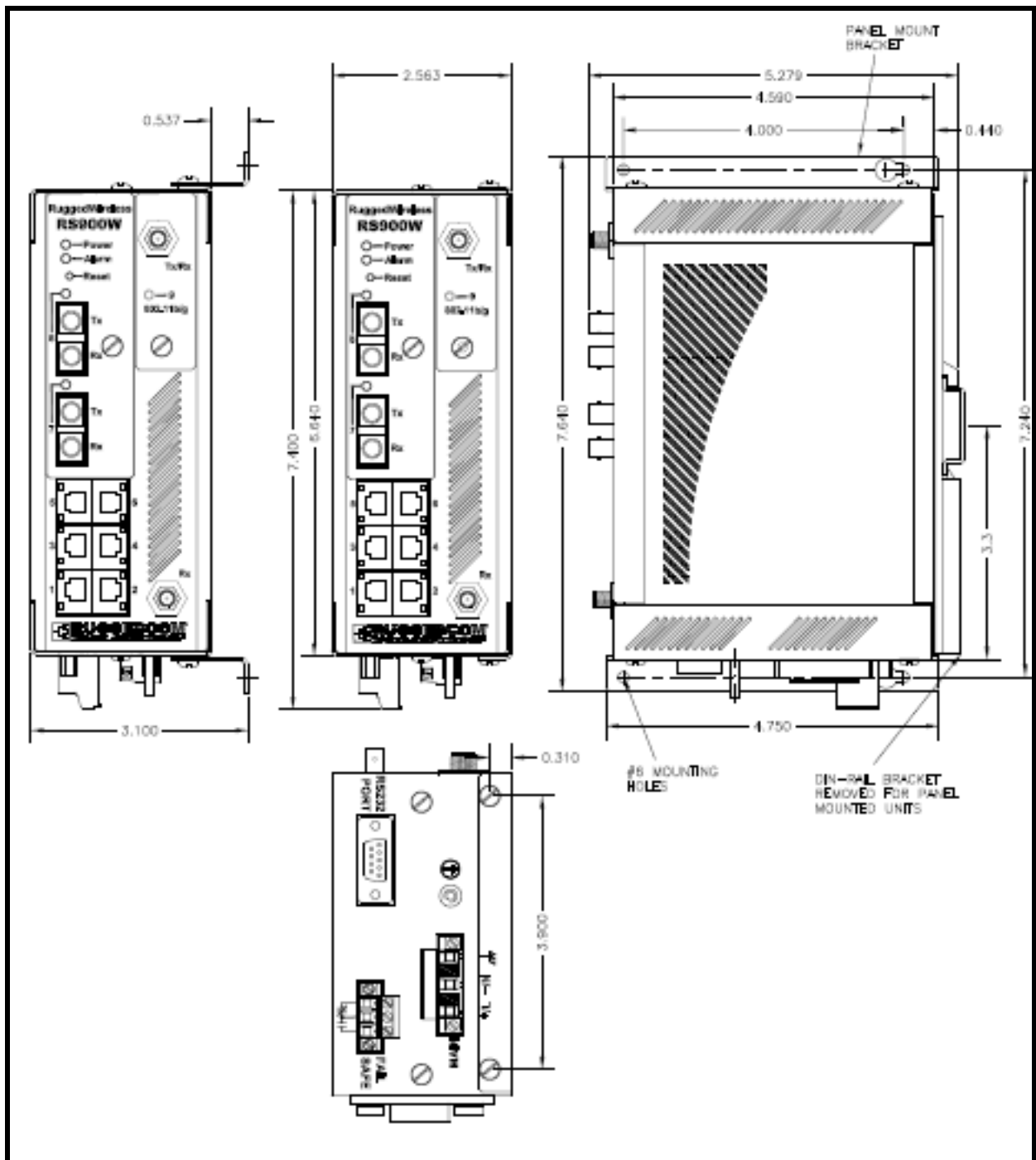


Figure 10 - Mechanical Specifications

Parameter	Value	Comments
Dimensions	7,4 x 2,6 x 5,0 inches (187,96) x (66,04) x (127,0) mm	(Length x Width x Depth)
Weight	2.7 lb (1.2 Kg)	
Enclosure	20 AWG Galvanized Steel	

Table 13 - Physical Dimensions

3.10 Agency Approvals

Agency	Standards	Comments
CSA	CSA C22.2 No. 60950, UL 60950	Approved
CE	EN 60950, EN 61000-6-2	CE Compliance is claimed via Declaration of Self Conformity Route
FCC	FCC Part 15, Class A	Approved
CISPR	EN55022, Class A	Approved
FDA/CDRH	21 CFR Chapter 1, Subchapter J	Approved
IEC/EN	EN60825-1:1994 + A11:1996 + A2:2001	Approved
CSA	Class 1, Division 2 Hazardous Locations Gas Groups: A,B,C, and D Temp. Code: T6 at 40C°, T4A at 85C°	Approved

Table 14 - Agency Approvals

4 Warranty

RuggedCom warrants this product for a period of five (5) years from date of purchase. For warranty details, visit <http://www.ruggedcom.com> or contact your customer service representative. Should this product require warranty or service contact the factory at:

RuggedCom Inc.
30 Whitmore Road,
Woodbridge, Ontario
Canada L4L 7Z4

Phone: (905) 856-5288
Fax: (905) 856-1995

5 Appendix A - RuggedWireless™ Frequently Asked Questions (FAQ)

What factors can affect wireless coverage/range?

Range estimates are typical and require line of sight. Basically that means you will need a clear unobstructed view of the antenna from the remote point in the link. Keep in mind that walls and obstacles will limit your operating range and could even prevent you from establishing a link. Signals in the 2.4 Ghz generally will not penetrate metal or concrete walls. Trees and leaves are also obstructions to 802.11 frequencies so they can partially (or even entirely) block the signal. Other factors that will reduce range and affect coverage area include metal studs in walls, concrete fiberboard walls, aluminum siding, foil-backed insulation in the walls or under the siding, pipes and electrical wiring, furniture and sources of interference. Other sources of interference include the microwave oven, other wireless equipment, cordless phones, radio transmitters and other electrical equipment. Due to the increased gain, installing range extender antennas in the presence of interference could actually yield either no improvement or worse range.

Which WiFi (802.11) Antenna type should I choose? Patch/Directional Antennas

Choose a patch if you want the signal more focused than from an omni-directional antenna. Patch antennas typically transmit the signal with approximately a 30 degree beam width. This is ideal for use in office locations, ie placed at one end of room to provide coverage for it's entire length. They can also be used outdoors to provide short distance point to point links.

When would I choose a Parabolic Grid Antenna?

These antennas have a very narrow beamwidth and are ideal for point-to-point bridge links. Grid antennas are highly directional and they should only be chosen to aim at one small (i.e. concentrated) spot.

When would I choose an Omni-Directional Antenna?

Choose an Omni-directional antenna to provide a signal over a full 360 degree radius.

How many clients can associate with an access point?

An Access Point is a shared medium and acts as a wireless hub. The performance of each user decreases as the number of users increases on an individual AP. Ideally, not more than 24 clients should associate with the AP because the throughput of the AP is reduced with each client that associates to the AP.

How do I convert between power expressed in 'milliwatt' and power expressed in 'dBm' units?

The formula used to convert stated 'power' levels to decibels (dBm – milliwatt @ 50 or 600 ohm impedance) is given as: **$\text{dBm} = 10 * \text{Log} (\text{Power in mW} / 1 \text{ mW})$**

Conversely, the formula used to convert stated 'power' levels to milliwatts when expressed in dBm is given as: **$\text{Power (mW)} = \text{anti-log} (\text{dBm} / 10)$**

dBm	Watts		dBm	Watts		dBm	Watts
0	1.0 mW		16	40 mW		32	1.6 W
1	1.3 mW		17	50 mW		33	2.0 W
2	1.6 mW		18	63 mW		34	2.5 W
3	2.0 mW		19	79 mW		35	3.2 W
4	2.5 mW		20	100 mW		36	4.0 W
5	3.2 mW		21	126 mW		37	5.0 W
6	4 mW		22	158 mW		38	6.3 W
7	5 mW		23	200 mW		39	8.0 W
8	6 mW		24	250 mW		40	10 W
9	8 mW		25	316 mW		41	13 W
10	10 mW		26	398 mW		42	16 W
11	13 mW		27	500 mW		43	20 W
12	16 mW		28	630 mW		44	25 W
13	20 mW		29	800 mW		45	32 W
14	25 mW		30	1.0 W		46	40 W
15	32 mW		31	1.3 W		47	50 W

Table 15 - dBm to Watt Conversion Table